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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,698	11/08/2003	Ji-Yen Cheng	78438-244401	5239
44920	7590	10/31/2007		
Venable LLP Raymond J. Ho 575 7th Street NW Washington, DC 20004-1601			EXAMINER MILLER, MICHAEL G	
			ART UNIT 1792	PAPER NUMBER
			MAIL DATE 10/31/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No. 10/705,698	Applicant(s) CHENG ET AL.	
	Examiner Michael G. Miller <i>MGM</i>	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 August 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) 8, 10 and 12 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 9, 11 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Election/Restrictions***

- 1) Applicant's election without traverse of Claims 1-7, 9 and 11 in the reply filed on 9 August 2007 is acknowledged.
- 2) Claims 8, 10 and 12 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 9 August 2007.

### ***Specification***

- 3) The disclosure is objected to because of the following informalities: There are several grammatical inconsistencies throughout the specification (e.g. 'The present invention disclosed a method for preparation and surface modification of plastic microfluidic chip is disclosed', Page 4 Lines 1-2, is exemplary). Appropriate correction is required.

### ***Claim Objections***

- 4) Claims 1, 7 and 11 are objected to because of the following informalities: There are grammatical inconsistencies in the claims. Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

5) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6) The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

- i) Determining the scope and contents of the prior art.
- ii) Ascertaining the differences between the prior art and the claims at issue.
- iii) Resolving the level of ordinary skill in the pertinent art.
- iv) Considering objective evidence present in the application indicating obviousness or nonobviousness.

7) Claims 1-5, 7, 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Henry et al ("Surface Modification of Poly(methyl methacrylate) Used in the Fabrication of Microanalytical Devices", Analytical Chemistry, 72, 21, 5331-5337, hereinafter Henry) in view of Klank et al ("CO<sub>2</sub>-laser micromachining and back-end processing for rapid production of PMMA-based microfluidic systems", Lab on a Chip 2, 2002, 2, 242-246, hereinafter "Klank") and Fulcrand et al (U.S. Patent 6,319,674, hereinafter '674).

8) With regard to Claim 1, Henry teaches a method for preparation and surface modification of a plastic microfluidic chip, comprising:

- i) Subject said substrate to physical surface modification (5332 paragraph 3, wherein the substrates are machined on edge to a given size, therefore physically modifying the surface area); and
- ii) Treat said substrate with a surface modification agent (5332 paragraph 3, exposure to N-lithioethylenediamine or N-lithiodiaminopropane).
- iii) Henry is silent as to the following limitations:
  - (a) Prepare a plastic substrate is prepared;
  - (b) Form a pattern with desired trench size and aspect ratio in said plastic substrate;
  - (c) Treat surface of said substrate is treated with chemical reduction to produce hydroxyl groups (-OH).
- iv) Henry also teaches that is known to produce polymer-based MEMS by laser ablation (5331 paragraph 4).
- v) Klank teaches a method of preparing a plastic substrate (242, paragraph 4, naming PMMA) by forming trenches of a given size and aspect ratio by laser ablation (last two paragraphs of 243 – first two paragraphs of 244).
- vi) Examiner takes the position that laser ablation is physical modification of the surface, both by changing its topography and by locally annealing the sidewalls of the carved trenches.
- vii) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the method of Henry with the method of Klank, as Henry is modifying a material to be used in

making MEMS devices and Klank is preparing a material to be used in making MEMS devices.

viii) Henry/Klank are silent as to the following limitation:

(a) Treat surface of said substrate is treated with chemical reduction to produce hydroxyl groups (-OH).

ix) Henry teaches reaction of a silane compound with amino-functionalized surfaces to adhere the silane compound to a substrate (5332, Schemes 1 and 2).

x) '674 teaches treatment of a surface to provide hydroxyl groups (Column 14 Line 46 – Column 15 Line 35; see specifically Column 15 Lines 15-20 for a surface with -OH termination) through which a silane compound can adhere to the surface.

xi) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the method of Henry/Klank with the technique of '674 because Henry/Klank want to adhere silane-containing molecules to functional groups on a surface and '674 teaches that silane-containing groups can be adhered to -OH functional groups on a surface.

9) With specific regard to Claim 2, Henry/Klank/'674 teaches the method according to claim 1 wherein:

i) said plastic substrate is a PMMA substrate (Klank 242, paragraph 4).

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10) With specific regard to Claim 3, Henry/Klank/'674 teaches the method according to claim 1 wherein:

- i) said plastic substrate is carved with a laser scribe to form said pattern (Klank 242, paragraph 5).

11) With specific regard to Claim 4, Henry/Klank/'674 teaches the method according to claim 3 wherein:

- i) Said plastic substrate is carved with a direct write laser scribe to form said pattern (Klank 242, paragraph 5, as the laser is directly carving the channel and not a byproduct from the laser).

12) With specific regard to Claim 5, Henry/Klank/'674 teaches the method according to claim 1 wherein:

- i) Said physical surface modification comprises thermal annealing treatment (Klank 242 paragraph 6 – 243 paragraph 4, discussing the melting of the material in the trench and the heating of the trench walls, which constitutes localized thermal annealing).

13) With specific regard to Claim 7, Henry/Klank/'674 teaches the method according to claim 1 wherein:

- i) Said surface modification agent comprises amino functional groups (Henry, 5332 paragraph 3).

14) With specific regard to Claims 9 and 11, Henry/Klank/'674 teaches the method according to claim 1 wherein:

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- i) Said surface modification agent comprises aminated organosilanes (Column 14 Line 64 – Column 15 Line 35 for the modification agent, Column 9 Lines 20-40 for the mention of the polymethacrylate family, of which PMMA is a member).
- ii) Claim 11 is rejected on the same basis as Claim 9 (Column 14 Lines 64-67 teach 3-(aminopropyl)triethoxysilane; Column 15 Lines 31-35 teach that the silyl functionality can be triethoxysilane or trimethoxysilane).

15) Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over

Henry/Klank/'674 in view of McMurry ("Organic Chemistry", Brooks/Cole Publishing Company, 1984, pp 639-640, hereinafter McMurry).

16) With specific regard to Claim 6, Henry/Klank/'674 teaches the method according to claim 1 except for the following limitation:

- i) Said reduction agent comprises lithium aluminum hydride (LAH).
- ii) McMurry teaches that lithium aluminum hydride is known to reduce ester compounds to primary alcohols, yielding hydroxyl functional groups (pp 639-640).
- iii) Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to have modified the method of Henry/Klank/'674 to include the technique of McMurry, as Henry/Klank/'674 want to modify the PMMA surface and McMurry teaches that the ester portion of the PMMA surface can be modified to a hydroxyl group.



**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael G. Miller whose telephone number is (571) 270-1861. The examiner can normally be reached on M-F 7-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MGM *MGM*

  
**FRED J. PARKER**  
**PRIMARY EXAMINER**